1. Introduction

\*No Deliverables\*

1. Multivariate Gaussian Distributions and Whitening
2. Scatter plots for , , and

Chart, scatter chart

Description automatically generated

*Figure 1: W*

Chart, scatter chart

Description automatically generated

*Figure 2:*

Chart, scatter chart

Description automatically generated

*Figure 3: X*

1. Print out of the image showing the connected set for s = (67, 45), and T = 3
   1. Theoretical value of the covariance matrix
   2. Numerical listing of covariance estimate
   3. Scatter plots for and

Chart, scatter chart

Description automatically generated

*Figure 4:*

*Chart, scatter chart

Description automatically generated*

*Figure 5: W*

* 1. Numerical listing of covariance estimate

1. Estimation of Eigenvectors and Eigenvalues Using the Singular Value Decomposition

\*No Deliverables\*

1. Eigenimages, PCA, and Data Reduction
2. Figure of first 12 eigenimages



*Figure 6: First 12 Eigenimages*

1. Plot of projection coefficients vs. eigenvector number

Chart, line chart

Description automatically generated

*Figure 7: Projection Coefficients vs Eigenvector Number*

1. Original image and the 6 resynthesized versions

A picture containing text, dark

Description automatically generated

*Figure 8: Original ‘a’ Image*



*Figure 9: 6 Resynthesized versions of ‘a’*

1. Image Classification
2. Mis-classified image list using

|  |  |
| --- | --- |
| **Actual Letter** | **Mis-Classified As** |
| d | a |
| j | y |
| l | i |
| n | v |
| p | e |
| q | a |
| u | a |
| y | v |

1. Mis-classified image lists using various
   1. Using

|  |  |
| --- | --- |
| **Actual Letter** | **Mis-Classified As** |
| i | l |
| y | v |

* 1. Using

|  |  |
| --- | --- |
| **Actual Letter** | **Mis-Classified As** |
| g | q |
| y | v |

* 1. Using

|  |  |
| --- | --- |
| **Actual Letter** | **Mis-Classified As** |
| f | t |
| y | v |

* 1. Using

|  |  |
| --- | --- |
| **Actual Letter** | **Mis-Classified As** |
| f | t |
| g | q |
| y | v |

1. Further Questions:
   1. **1. Which of the above classifiers worked the best in this experiment?**

Classification using , , and worked the best in this experiment. This is because these selections led to the least number of mis-classified letters

* 1. **In constraining the covariance, what is the trade off between the accuracy of the data model and the accuracy of the estimates?**

When the covariance is constrained, the accuracy of the estimates is increased as seen in the previous results. However, the accuracy of the data model is decreased because the ground-truth of the training data is not captured. When the covariance matrix is modified, certain statistical relationships among the training data are not maintained.